Random Variables Checkpoint 2

Question (1)

The number of people in a car that crosses a certain bridge is represented by the random variable X, which has a mean value μ_X = 2.7, and a variance σ^2_X = 1.2. The toll on the bridge is $3.00 per car plus $ .50 per person in the car. The mean and variance of the total amount of money that is collected from a car that crosses the bridge are:

A: mean = $1.35, variance = $ .30.

B: mean = $8.60, variance = $ .30.

C: mean = $8.60, variance = $ .60.

D: mean = $4.35, variance = $3.30.

E: mean = $4.35, variance = $ .30.

Feedback

A : 0

✗ This is not quite right. You do have the correct variance since $\sigma^2_{a + b X} = b^2 \sigma^2_X = (.5)^2(1.2)$. However, your mean is incorrect. Remember that $\mu_{(a + b X)} = a + b \mu_X$. The transformation you used was .5 X. However, you forgot about the constant part of the toll, which is the $3.00 that each car must pay. Consider the remaining options. (E) is the right answer.

B : 0

✗ This is not quite right. You do have the correct variance since $\sigma^2_{a + b X} = b^2 \sigma^2_X = (.5)^2(1.2)$. However, your mean is incorrect. Remember that $\mu_{(a + b X)} = a + b \mu_X$. You used $\mu_{(a + b X)} = .5 + 3 \mu_X$. However, the constant part of the toll is $3.00/car and the variable part is $ .50/mile. Consider the remaining options. (E) is the right answer.

C : 0

✗ This is not quite right. Remember that $\mu_{(a + b X)} = a + b \mu_X$ and $\sigma^2_{a + b X} = b^2 \sigma^2_X$. The "***a***" represents the constant part of the toll

and the "***b***" represents the variable part. Consider the remaining options. (E) is the right answer.

D : 0

This is not quite right. You do have the correct mean since $\mu_{(a + b X)} = a + b \mu_X = 3 + .5(2.7)$. Remember that $\sigma^2_{a + b X} = b^2 \sigma^2_X$. It appears that you used $\sigma^2_{a + b X} = a + b^2 \sigma^2_X$. Consider the remaining options. (E) is the right answer.

E : 10

Good job! Let T be the total amount of money that is collected from a car that crosses the bridge. T is composed of two parts: the fixed toll of 3 dollars (regardless of the number of passengers) and $ .50 for every passenger, thus T = 3 + 0.50 * X. To find the mean and variance of T you need to use the rules of means and variances:

$$\mu_T = \mu_{3+0.50*X} = 3 + 0.50 * \mu_X = 3 + 0.50 * 2.7 = 4.35$$

$$\sigma^2_T = \sigma^2_{3+0.50*X} = (0.50)^2 * \sigma^2_X = 0.25 * 1.20 = 0.30$$

Question (2)

A parking garage has two entrances. Let X be the number of cars that enter the garage through door A in an hour, and Y be the number of cars that enter through door B in an hour. Assuming that $\mu_x = 15$ and $\mu_y = 25$, what is the mean of Z, the total number of cars that enter the garage in an hour.

A: 10
B: 15
C: 25
D: 40
E: The mean of Z cannot be determined.

Feedback

A : 0

That is not quite right. Recall that since Z = X + Y, $\mu_z = \mu_x + \mu_y$.

✗ 10 would be $\mu_y - \mu_x$. (D) is the right answer.

B : 0

✗ That is not quite right. Recall that since $Z = X + Y$, $\mu_z = \mu_x + \mu_y$. 15 is just μ_x. (D) is the right answer.

C : 0

✗ That is not quite right. Recall that since $Z = X + Y$, $\mu_z = \mu_x + \mu_y$. 25 is just μ_y. (D) is the right answer.

D : 10

✓ Good job! Since $Z = X + Y$, $\mu_z = \mu_x + \mu_y$.

E : 0

✗ That is not quite right. Recall that since $Z = X + Y$, $\mu_z = \mu_x + \mu_y$. (D) is the right answer.